TST Spreadsheet Tool v1.9

TST Summary
The Test of Significant Toxicity (TST) is a new statistical approach that assesses the whole effluent toxicity (WET) measurement of wastewater effects on specific test organisms' ability to survive, grow, and reproduce developed by the U.S. EPA. TST uses hypothesis testing techniques which examines whether a sample, at the critical concentration (e.g., in-stream waste concentration or IWC), and the control within a WET test differ by an unacceptable amount (the amount that would have a measured adverse effect on the ability of aquatic organisms to thrive and survive). A sample can be either an effluent, stormwater, or receiving water. Once the WET test has been conducted, the TST approach can be used to analyze valid WET test data to assess whether the sample is toxic. The TST approach is designed to be used for a two concentration data analysis of the sample's critical concentration (e.g., IWC or a receiving water concentration) as compared to a control concentration.

TST Spreadsheet Tool
This tool was created for several of the EPA WET test methods for the West Coast marine species (USEPA 1995) and the 2002 EPA WET test methods (USEPA 2002a, 2002b, 2002c) for other species.

For questions, please contact:
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Instructions
Before using this program, Macros must be enabled and the security certificate must be accepted.

For Excel 2007:
1. Click the "Office Button" (big Office logo in the upper left), and select "Excel Options" (lower right)
2. Click "Trust Center" on the left menu
3. Click "Trust Center Settings" (lower right)
4. Click "Macro Settings"
5. Click "Enable all macros" (last option)
6. Click "ok" buttons to clear all open windows
7. Exit program and re-open the file to use

For Excel pre-2007:
1. Go to "Tools", "Macro", and Click "Security"
2. Set Macro security to medium
3. Exit program and re-open file
4. Click "Enable Macros"

To use the program:
1. Enter test information in the first block of pink shaded cells - Lab Name, Client Name, Test ID, Test Date, Test Duration, and IWC (Critical Concentration)
* "Critical Conc." means a facility specific IWC or 100% receiving water, etc. (i.e., one concentration of WET test)
2. Fill in your raw test data (Number of Organisms Exposed or Counted and Response) for as many replicates as conducted in WET test
* Percent data (survival, germination, etc.) should be input as whole numbers (not as decimals)
* Fish growth must be input as biomass
3. Choose the appropriate test information from the pink "Click to choose from menu" cells
4. All gray cells will fill-in automatically if needed
5. Click on the yellow button to save data to the "Statistics" tab if desired
* This will create a running log of the calculated values for each test entered
6. Click on the "TST Summary Sheet" tab for a printer friendly version of the data and print if desired
7. Click on the green button on the "Calculator" tab to clear all the red input cells to enter new dataset
* Clearing the data on the "Calculator" tab will also clear the "TST Summary Sheet" - be sure to print before clearing
8. Enter your next set of test data as directed above and a log of your data will be formed on the "Statistics" tab
9. You must save the Excel workbook file when finished if you want your data to be available the next time you open the file

Results description:
A t-value is calculated for your dataset ("Calculated t-value") and compared against the "Critical t-value" based on the degrees of freedom of your dataset. If the Calculated t-value is greater than the Critical t-value, then the sample is not toxic at that concentration. If the calculated value is less than or equal to the critical value, then the sample is toxic. In the event that there is no variance in both the control and the IWC, the percent effect is used to determine whether the sample is toxic.

Notes:
For acute tests with optional 2 or 4 replicates (e.g., fathead minnow), TST requires 4 replicates.
The chronic survival analysis is **not** available for *C. dubia*.
For a list of alpha, beta, and b (RMD) values for each test method/species, please refer to Table 1 of the Toxicity Provisions.
If no variance in both the control and the IWC, a percent effect <25% for chronic, or <20% for acute is considered "Passing".

TST Calculator v1.9 Updates (performed April 2021):
The calculator was expanded to allow the user to input data for up to 40 replicates, instead of 20.
Minor formatting changes were made, in order to make the spreadsheet tool more accessible to individuals with disabilities (e.g. removed merged cells).
The "TST Summary Sheet" sheet was rearranged to allow data from up to 40 replicates to fit on one printed page.
Screen tips were added to the "Calculator" sheet, to provide instructions when the data input cells are selected.
The VBA code and hidden sheets were updated to work properly with the updated "Calculator" tab.
Certain terms used in the spreadsheet were slightly changed.
The "Example" sheet was updated in order to match the updated "Calculator" sheet.

TST Calculator v1.8 Updates:
TST Calculator v1.7 was updated to include space for a lab and client name, as well as making cells larger for test information input.

Click here to clear input cells and enter new

Lab Name	Example Laboratory
Client Name	Example Client
Test ID	Test_001
Test Date	4/14/2020
Test Duration	7 day
IWC	50% effluent

Replicate Number	Control Data: Number of Organisms Exposed or Counted	Control Data: Response (Final Count, Weight, Length, etc.)	IWC (Instream Waste Concentration) Data: Number of Organisms Exposed or Counted	IWC (Instream Waste Concentration) Data: Response (Final Count, Weight, Length, etc.)	Control	IWC
1	10	10	10	9	1	0.9
2	10	9	10	8	0.9	0.8
3	10	10	10	9	1	0.9
4	10	10	10	8	1	0.8
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Arcsine SqRt Transformation

Control	Critical Conc. (IWC)
1.412	1.249
1.249	1.107
1.412	1.249
1.412	1.107

Test Species? *P. promelas (fathead minnow)*

Chronic or Acute? Acute

Endpoint? Survival

Percent Data? Yes

b= 0.80

α= 0.10

Click to choose from menu
Fertilization
Germination
Germ-Tube Length
Grow th
Larval Development
Reproduction
Survival

Click to choose from menu
A. affinis (topsmelt)
A. bahia (mysid shrimp)
A. punctulata (echinoderm)
C. dubia (w ater flea)
C. gigas (oyster)
C. variegatus (sheepshead minnow)
D. excentricus (echinoderm)
D. magna (w ater flea)
D. pulex (w ater flea)
H. azteca (amphipod)
H. costata (mysid)
H. rufescens (red abalone)
M. berrylina (inland silverside)
M. menidia (atlantic silverside)
M. peninsulae (tidew ater silverside)
M. pyrifera (giant kelp)
Mytilus sp. (mussel)
O. mykiss (rainbow trout)
P. promelas (fathead minnow)
S. capricornutum (green algae)
S. fontinalis (brook trout)
S. purpuratus (echinoderm)
T. gratilla (echinoderm)

Click to choose from menu
Acute
Chronic

Conduct WET Test
↓
Apply arcsine square root transformation for percent data
↓
Calculate t value using TST Welch's test
↓
Calculated t-value > critical t-value?

↓
YES
"PASS"
Sample is NOT Toxic

↓
NO
"FAIL"
Sample is Toxic

If no variance in both the control and the IWC, a % difference <25 for chronic, or <20 for acute is considered "Passing".

Statistic	Control	IWC
Percent Mean of Raw Data	0.98	0.85
Mean used in Calcuation (transformed)	1.37	1.18
Variance used in Calcuation (transformed)	0.007	0.007
Standard Deviation of Transformed Data	0.081	0.082
CV of Transformed Data	0.059	0.070
n	4	4

Mean % Effect at IWC	12.82

Calculated t-value=	1.5488
Degrees of Freedom (v)=	5
Critical t-value=	1.4759

Click here to save data to "Statistics" worksheet

Cell: B4
Comment: The cells in this table (cells B4:B9) are not part of the calculation. They only provide a qualitative description of each test.

Cell: S10
Comment: Highlighted cells indicate the result for your data set.

Cell: I11
Comment: If the arcsine square root transformation is necessary, the grey cells in this table fill in automatically.

Cell: D12
Comment: The "Number of Organisms Exposed or Counted" columns (for both the control and IWC) are only used if the test endpoint utilizes percent data (proportions of a binary response). For test endpoints that do not use percent data (e.g. Ceriodaphnia reproduction), these columns may be left blank.

Cell: B13
Comment: In this example, 10 fish were exposed in each of the four replicates. On the final day of testing, the final count was 10 surviving fish for Replicate 1, 3, and 4, while the final count for Replicate 2 was 9.

Click here to clear input cells and enter new

Lab Name	Pacific EcoRisk
Client Name	Elk River WWTP
Test ID	14-9645-1595
Test Date	9/9/2020
Test Duration	47h
IWC	100

Replicate Number	Control Data: Number of Organisms Exposed or Counted	Control Data: Response (Final Count, Weight, Length, etc.)	IWC (Instream Waste Concentration) Data: Number of Organisms Exposed or Counted	IWC (Instream Waste Concentration) Data: Response (Final Count, Weight, Length, etc.)
1	10	16.8	10	15.8
2	10	14.5	10	16.8
3	10	15.8	10	16
4	10	16.2	10	16.8
5	10	17.8	10	16.5
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Control IWC

Arcsine SqRt Transformation	
Control	Critical Conc. (IWC)

Click to choose from menu
Fertilization
Germination
Germ-Tube Length
Grow th
Larval Development
Reproduction
Survival

Click to choose from menu
A. affinis (topsmelt)
A. bahia (mysid shrimp)
A. punctulata (echinoderm)
C. dubia (w ater flea)
C. gigas (oyster)
C. variegatus (sheepshead minnow)
D. excentricus (echinoderm)
D. magna (w ater flea)
D. pulex (w ater flea)
H. azteca (amphipod)
H. costata (mysid)
H. rufescens (red abalone)
M. berryllina (inland silverside)
M. menidia (atlantic silverside)
M. peninsulae (tidew ater silverside)
M. pyrifera (giant kelp)
Mytilus sp. (mussel)
O. mykiss (rainbow trout)
P. promelas (fathead minnow)
S. capricornutum (green algae)
S. fontinalis (brook trout)
S. purpuratus (echinoderm)
T. gratilla (echinoderm)

Click to choose from menu
Acute
Chronic

Conduct WET Test
↓
Apply arcsine square root transformation for percent data
↓
Calculate t value using TST Welch's test
↓
Calculated t-value > critical t-value?

↓ YES
"PASS"
Sample is NOT Toxic

↓ NO
"FAIL"
Sample is Toxic

If no variance in both the control and the IWC, a % difference <25 for chronic, or <20 for acute is considered "Passing".

Statistic	Control	IWC
Mean of Raw Data	16.22	16.38
Mean used in Calculation (non-transformed)	16.22	16.38
Variance used in Calculation (non-transformed)	1.492	0.212
Standard Deviation of Raw Data	1.221	0.460
CV of Raw Data	0.075	0.028
n	5	5

Mean % Effect at IWC	-0.99

Calculated t-value=	9.1924
Degrees of Freedom (v)=	5
Critical t-value=	2.0150

Click here to save data to "Statistics" worksheet

Test Species? *M. pyrifera (giant kelp)*

Chronic or Acute? Chronic

Endpoint? Germ-Tube Length

Percent Data? No

b= 0.75

α= 0.05

TST Summary Sheet

Lab Name	Pacific EcoRisk	**Client Name**	
Test ID	14-9645-1595	**Test Species**	
Test Date	9/9/2020	**Test Type**	
Duration	47h	**Endpoint**	
IWC	100		

Statistic	Control
Mean of Raw Data	16.22
Mean used in Calculation (non-transformed)	16.22
Variance used in Calculation (non-transformed)	1.492
Standard Deviation of Raw Data	1.221
CV of Raw Data	0.075
n	5

TST Summary Sheet

Elk River WWTP

M. pyrifera (giant kelp)

Chronic

Germ-Tube Length

Instream Waste Concentration (IWC)
16.38
16.38
0.212
0.460
0.028
5

TST Summary Sheet

Mean Percent Effect at the IWC

-0.99

Calculated t-value	Degrees of Freedom	Critical t-value
9.1924	5	2.0150

Results

Pass Sample is Non-toxic

Raw Data

Control Data			
Number of Organisms Exposed or Counted	Response (Final Count, Weight, Length, etc.)	Number of Organisms Exposed or Counted	Response (Final Count, Weight, Length, etc.)
10	16.8		
10	14.5		
10	15.8		
10	16.2		
10	17.8		

TST Summary Sheet

Percent Effect (if no variance)

Instream Waste Concentration Data			
Number of Organisms Exposed or Counted	Response (Final Count, Weight, Length, etc.)	Number of Organisms Exposed or Counted	Response (Final Count, Weight, Length, etc.)
10	15.8		
10	16.8		
10	16		
10	16.8		
10	16.5		

Lab Name	Client Name	Test ID	Test Date	Test Duration	IWC	Test Species	Chronic or Acute	Endpoint	Mean % Effect at IWC	Calculated t-value	Critical t-value	Percent Difference	Pass or Fail	Toxic or Non-toxic
Pacific EcoRisk	Elk River WWTP	14-8929-2351	11/30/2016	96h	100	A. bahia (mysid shrimp)	Acute	Survival	2.50	5.931401698	1.637744354		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	00-0932-7329	11/30/2016	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	-5.52	24.81995566	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	00-0932-7329	11/30/2016	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	13.55	3.84213956	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	21-2822-8614	2/15/2017	94h	100	A. bahia (mysid shrimp)	Acute	Survival	2.63	4.063108598	1.475884049		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	09-7602-7453	2/15/2017	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	6.52	9.557107279	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	09-7602-7453	2/15/2017	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	9.57	5.935708092	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	15-2236-2247	5/2/2017	95h	100	A. bahia (mysid shrimp)	Acute	Survival	-5.56	4.772110592	1.475884049		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	17-0081-6497	5/2/2017	46h	100	M. pyrifera (giant kelp)	Chronic	Germination	0.21	26.97853322	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	17-0081-6497	5/2/2017	46h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	1.55	29.12	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	19-4836-3692	7/25/2017	94h	100	A. bahia (mysid shrimp)	Acute	Survival	2.50	5.931401698	1.637744354		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	02-3790-8842	7/25/2017	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	23.70	0.70801086	2.015048373		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	02-3790-8842	7/25/2017	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	3.31	12.03642301	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	07-2770-7486	10/19/2017	95h	100	A. bahia (mysid shrimp)	Acute	Survival	2.83	2.801403513	1.533206274		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	15-3050-6791	10/19/2017	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	-7.04	14.81571609	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	15-3050-6791	10/19/2017	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	8.81	6.724053806	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	10-5585-9228	1/23/2018	94h	100	A. bahia (mysid shrimp)	Acute	Survival	0.00			0	Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	07-2655-3340	1/23/2018	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	5.62	5.603262651	2.015048373		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	07-2655-3340	1/23/2018	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	30.01	-2.102476674	1.943180281		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	00-8288-4661	7/31/2018	94h	100	A. bahia (mysid shrimp)	Acute	Survival	2.50	5.968550663	1.637744354		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	12-7901-0230	7/31/2018	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	-4.82	9.307021665	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	12-7901-0230	7/31/2018	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	3.02	9.824956663	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	12-5569-9658	1/23/2019	95h	100	A. bahia (mysid shrimp)	Acute	Survival	5.56	1.79775394	1.533206274		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	02-8662-2279	2/7/2019	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	27.54	0.365403339	1.943180281		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	02-8662-2279	2/7/2019	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	26.39	-1.163345968	1.894578605		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	09-1354-0387	4/17/2019	94h	100	A. bahia (mysid shrimp)	Acute	Survival	-2.70	3.911379708	1.475884049		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	06-1722-8323	4/17/2019	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	-3.85	19.79215322	2.015048373		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	06-1722-8323	4/17/2019	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	-3.23	24.47359341	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	06-5717-1310	8/1/2019	95h	100	A. bahia (mysid shrimp)	Acute	Survival	0.00			0	Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	17-4816-2075	9/12/2019	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	6.64	9.20139003	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	17-4816-2075	9/12/2019	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	13.08	6.532638009	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	09-3202-5383	11/6/2019	95h	100	A. bahia (mysid shrimp)	Acute	Survival	0.00			0	Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	03-4473-5056	11/6/2019	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	-6.21	11.60134585	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	03-4473-5056	11/6/2019	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	-0.80	12.13384713	2.131846786		Pass	Non-toxic
Pcific EcoRisk	Elk River WWTP	13-8901-4450	2/19/2020	94h	100	A. bahia (mysid shrimp)	Acute	Survival	-2.63	5.532214919	1.475884049		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	03-6678-6543	2/19/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	57.46	-13.30775589	1.943180281		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	03-6678-6543	2/19/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	35.08	-14.39818365	1.894578605		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	12-4562-6212	4/15/2020	94h	100	A. bahia (mysid shrimp)	Acute	Survival	-2.56	9.664252123	1.637744354		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	11-1541-8122	4/15/2020	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	2.62	6.430182567	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	11-1541-8122	4/15/2020	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	10.17	8.775960435	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	12-5867-9077	5/1/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	19.72	3.004345768	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	12-5867-9077	5/1/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	9.41	17.30141862	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	20-9567-2622	8/5/2020	95h	100	A. bahia (mysid shrimp)	Acute	Survival	2.70	3.623618468	1.637744354		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	15-5993-9967	8/5/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	75.36	-11.22590947	1.894578605		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	15-5993-9967	8/5/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	47.90	-14.51558026	2.015048373		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	14-9645-1595	9/9/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	-2.46	12.59935361	2.131846786		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	14-9645-1595	9/9/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	-0.99	9.192414026	2.015048373		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	02-0321-3433	9/23/2020	49h	100	M. pyrifera (giant kelp)	Chronic	Germination	8.99	9.107034821	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	02-0321-3433	9/23/2020	49h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	12.82	17.17366124	2.131846786		Pass	Non-toxic
Pacific EcoRisk	Elk Riper WWTP	10-3587-0125	10/29/2020	94h	100	A. bahia (mysid shrimp)	Acute	Survival	52.78	-2.76207837	1.475884049		Fail	Toxic
Pacific EcoRisk	Elk River WWTP	02-2482-6259	10/21/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	-15.64	26.52774572	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	02-2482-6259	10/21/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	11.59	6.161617255	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	20-9298-0974	10/7/2020	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	-1.74	9.402128384	1.943180281		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	20-9298-0974	10/7/2020	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	-4.25	6.531845473	2.131846786		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	20-9298-0974	10/21/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	11.59	6.161617255	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	11-8855-7332	2/24/2021	94h	100	A. bahia (mysid shrimp)	Acute	Survival	-2.50	3.859345663	1.475884049		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	09-6866-6539	2/24/2021	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	19.82	3.040490704	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	09-6866-6539	2/24/2021	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	5.47	4.62875538	2.131846786		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	16-4260-8545	5/5/2021	96h	100	A. bahia (mysid shrimp)	Acute	Survival	-2.49	5.543362053	1.475884049		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	17-7021-5685	6/4/2021	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	19.21	5.779878844	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	17-7021-5685	6/4/2021	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	12.69	4.642612121	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	03-6349-6775	3/18/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germination	14.12	14.54136944	2.015048373		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	03-6349-6775	3/18/2020	47h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	16.57	19.92251657	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	01-4033-6025	3/31/2020	48h	100	M. pyrifera (giant kelp)	Chronic	Germ-Tube Length	10.18	13.23355944	1.894578605		Pass	Non-toxic
Pacific EcoRisk	Elk River WWTP	01-4033-6025	3/31/2020	48h	100	M. pyrifera (giant kelp)	Chronic	Germination	15.21	19.48664845	1.894578605		Pass	Non-toxic

Date	*Americamysis bahia* % Survival	Units	Pass/Fail
November 29, 2016	97.5	%	Pass
February 14, 2017	92.5	%	Pass
May 1, 2017	95	%	Pass
July 24, 2017	97.5	%	Pass
October 18, 2017	92.5	%	Pass
January 22, 2018	100	%	Pass
April 24, 2018	95	%	Pass
July 30, 2018	97.5	%	Pass
October 9, 2018	100	%	Pass
January 22, 2019	85	%	Pass
April 16, 2019	95	%	Pass
July 31, 2019	100	%	Pass
November 5, 2019	100	%	Pass
February 18, 2020	97.5	%	Pass
April 14, 2020	100	%	Pass
August 4, 2020	90	%	Pass
October 28, 2020	42.5	%	Fail
February 23, 2021	95	%	Pass
May 4, 2021	97.5	%	Pass

Notes
Please note that low (i.e., <4.0 mg/L) dissolved oxygen (D.O.) was observed in the effluent treatment of the acute toxicity test during the routine morning check. The presence of low D.O. confounds our ability to interpret the test results. Given this, it is our best professional judgement that a re-test for the acute species is warranted.

Lab Name

Pacific EcoRisk

Formulas on this page (in Row 1) are used to copy data from Calculator worksheet to the Statistics w

PasteSpecial-Values

PasteSpecial-Formulas

Client Name	Test ID	Test Date	Test Duration	Critical Conc.
Elk River WWTP	14-9645-1595	9/9/2020	47h	100

orksheet.

Test Species	Chronic or Acute	Endpoint
M. pyrifera (giant kelp)	Chronic	Germ-Tube Length

Mean % Effect at Critical Conc.	Calculated t-value	Critical t-value	Percent Difference
-0.99	9.19	2.02	

Pass or Fail	Toxic or Non-toxic
Pass	Non-toxic